

09/845,454

F0662

REMARKS

Claims 1-12 and 25 are currently pending in the present application and are presently under consideration. All pending claims with status identifiers are found at pages 3-6.

Applicants' representative acknowledges with appreciation the Examiner's indication that claims 10-12 would be allowable if recast in independent form to recite all limitations of respective base claims and any intervening claims. However, it is believed such amendments are not necessary in view of the amendments herein and the deficiencies discussed *infra* of the cited art *vis a vis* applicant's claimed invention.

Favorable reconsideration is requested in view of the comments below.

I. Rejection of Claim 1 under 35 U.S.C. §103(a)

Claim 1 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Eriguchi, *et al.* (US 6,113,733) in view of Su. (US 6,486,492). Reconsideration and allowance of claim 1 is respectfully requested for at least the following reasons. Eriguchi, *et al.* and Su, individually or in combination, do not teach or suggest all the claim limitations of the subject invention.

In order to establish a prima facie case of obviousness, the teaching or suggestion to make the claim modification *must be found in the cited art*, not based on the applicant's disclosure. *In re Vaack*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). Furthermore, the mere fact that the reference can be modified does not render the modification obvious unless the cited art also suggests the desirability of the modification. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

In particular, and as will be discussed in detail below, neither Eriguchi, *et al.* nor Su teach or suggest *analyzing... etching parameter data by comparing the etching parameter data to stored etching data to generate a feed-forward control data operative to control the at least one etching component* as recited in this claim. Eriguchi, *et al.* teaches a system for detecting defects in a semi-conductor region *via* emitting two light beams - an exciting light and a monitoring light. The exciting light is utilized to excite carriers in the semiconductor region, thereby generating an electric field. The measuring

09/845,454

F0662

light is directed at the same semiconductor region and reflects from the semiconductor region to a capturing mechanism. The reflectance of the monitoring light alters in the presence and absence of the exciting light. Therefore, the exciting light is intermittently emitted, and measurements of reflectance of the monitoring light are taken during instances the exciting light is applied as well as when the exciting light is not applied. A "change rate" is thereafter calculated based upon alteration in reflectance of the monitoring light in the presence and absence of the exciting light (*See* col. 6, lines 8-36). Such alteration of reflectance can thereafter be utilized to determine number of defects in the semiconductor region, thickness of film in the semiconductor region, and depth of damaged layers in the semiconductor region. The Examiner relies on an embodiment disclosed within Eriguchi, *et al.* that states "the change rate ($\Delta R/R$) during plasma processing (light etching in the present embodiment) is compared with the initial change rate ($\Delta R/R$) of reflection intensity." *See* col. 29, lines 20-23. Thereafter, however, Eriguchi, *et al.* discloses that etching is controlled based on a value that was *preliminarily obtained* by experiment. *See* co. 29, lines 23-26. As such a threshold value was preliminarily obtained, a comparison of the initial value of change rate to the later value of change rate is not utilized *to generate feed-forward control data* as recited in this claim.

Furthermore, even if the "standard value" *preliminarily obtained* by experiment is derived *via* comparing an initial value of change rate to a current value of change rate, Eriguchi, *et al.* does not teach or suggest *analyzing measured etching parameter data* as recited in this claim. The term "*analyze*" is defined in the Fourth Edition of The American Heritage Dictionary as "to examine in such a manner as to ascertain the elements or nature of the thing examined." At most, Eriguchi, *et al.* teaches utilizing two disparate data points (initial change rate and current change rate) to obtain a "standard value" that itself was previously determined *via* experiment.

Su discloses a microscopy system utilized to monitor etching parameters, and then utilizing such monitored parameters as feed-forward information to facilitate control of a semiconductor manufacturing process. The microscopy techniques as taught in Su are expensive, time consuming, and can be destructive when compared to the optical system of the subject invention. Furthermore, like Eriguchi, *et al.*, Su does not teach or suggest

09/845.454

F0662

analyzing... etching parameter data by comparing the etching parameter data to stored etching data as recited in claim 1.

In view of at least the above, it is readily apparent that neither Eriguchi, *et al.* nor Su, alone or in combination, teach or suggest the subject invention as recited in independent claim 1. This rejection should be withdrawn.

II. Rejection of Claims 2-6 and 8 under 35 U.S.C. §103(a)

Claims 2-6 and 8 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Eriguchi, *et al.* and Su, and further in view of Xu, *et al.* (US 6,483,580). Withdrawal of this rejection is respectfully requested for at least the following reasons. Xu, *et al.* discloses a system for measuring film thickness and optical index of films underneath a diffracting structure utilizing a spectroscopic ellipsometer and an associated spectroscopic scatterometer. However, Xu, *et al.* does not make up for the aforementioned deficiencies of Eriguchi, *et al.* and Su. Therefore, this rejection should be withdrawn.

III. Rejection of Claims 7 and 9 under 35 U.S.C. §103(a)

Claims 7 and 9 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Eriguchi, *et al.*, Su, Xu, *et al.*, and further in view of Ko, *et al.* (US 6,117,791). Withdrawal of this rejection is respectfully requested for at least the following reasons. Claims 7 and 9 depend from independent claim 1. Claim 1 is believed to be in condition for allowance, rendering this rejection moot. Therefore, the subject rejection should be withdrawn.

IV. Rejection of Claim 25 under 35 U.S.C. §103(a)

Claim 25 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Jahns (US 5,711,843) in view of Su and further in view of Xu. Reconsideration and allowance of this claim is respectfully requested for at least the following reasons. Neither Jahns, Su, nor Xu teaches or suggests combining all elements of the subject claim.

09/845,454

F0662

Absent some teaching or suggestion in the prior art to combine elements, it is insufficient to establish obviousness by claiming that the separate elements of the invention existed in the prior art. *Arkie Lures Inc. v. Gene Larew Tackle Inc.*, 43 USPQ2d 1294, 1297 (Fed. Cir. 1997).

More particularly, the cited references do not teach or suggest *partitioning a wafer into... grid blocks and sensing the acceptability of etching in... grid blocks via scatterometry*. Jahns teaches monitoring process environment properties, such as temperature of plasma, gas flow rate, gas pressure, *etc.* (See col. 3 lines 38-44). One or more of such sensed environmental properties are relayed to a process condition monitor, which determines whether any of such properties (or a combination of properties) renders the process defective. Utilizing the invention as disclosed in Jahns, an etching process is labeled as defective based upon parameters within the process chamber, and not based upon parameters of a wafer being processed. Furthermore, the system of Jahns cannot determine portions of a wafer that are defective. Rather, an entire wafer would be deemed defective even in an instance that only a small portion of such wafer was actually defective and could be repaired. Moreover, upon determining that environmental properties are such that etching the wafer is acceptable, etch rates (and various other process parameters) are *estimated* by a classifier based on the environmental properties. Such an arrangement does not facilitate control of etch components particular to grid cells of a wafer. Rather, the processes are controlled for the entire wafer, thus not facilitating achievement of critical dimensions throughout the entirety of the wafer.

Su teaches exposing a wafer to create a focus-exposure matrix, and thereafter examining each matrix cell with a convention CD-SEM scan. Su does not teach or suggest utilizing *scatterometry means for sensing the acceptability of etching in... grid blocks*. Xu discloses utilizing scatterometry techniques to measure one or more parameters of a diffracting structure. Xu does not teach or suggest utilizing *scatterometry means for sensing acceptability of etching in a grid* of a wafer.

The cited prior art references do not exhibit benefits obtained *via* utilizing the invention as recited in the subject claim to control an etching process on a portion of a wafer. Partitioning of the wafer into a grid enables accurate determination of a location in which control of an etching component is required. For example, *via* monitoring

09/845,454

F0662

individual grid cells, an etching component can be controlled accordingly to facilitate achievement of desirable critical dimensions. Furthermore, the present invention enables *in situ* monitoring and control of an etching component pertaining to a particular grid cell without the expense, complexity, and risk associated with CD-SEM scans. Moreover, etch rates and various other process parameters can be directly measured and controlled, rather than predicting such etch rates based upon processing environment properties such as temperature and gas flow as disclosed in Jahn.

The Examiner has rejected this previous argument by stating that the argument "is not commensurate with the scope of the claim." The claim includes a limitation of *means for partitioning a wafer into one or more grid blocks*, and the term "partitioning" is defined as "The act or process of dividing something into parts" by The Fourth Edition of The American Heritage Dictionary. Thus, commensurate with the claim, the wafer has to be *partitioned*, and a grid block can thus not be the entire wafer. It is possible, however, to *partition* a wafer so that it includes a single grid block (*e.g.*, a single square within the wafer). Therefore, as described *supra*, a particular portion of a wafer can be monitored, corrected, or deemed defective without requiring an entire wafer to be defective.

In view of the foregoing, it is respectfully submitted that no teaching or suggestion to combine Jahn, Su, and Xu exists in the cited references. This rejection should be withdrawn.

09/845,454

F0662

V. Conclusion

The present application is believed to be condition for allowance in view of the above comments and amendments. A prompt action to such end is earnestly solicited.

In the event any fees are due in connection with this document, the Commissioner is authorized to charge those fees to Deposit Account No. 50-1063.

Should the Examiner believe a telephone interview would be helpful to expedite favorable prosecution, the Examiner is invited to contact applicants' undersigned representative at the telephone number listed below.

Respectfully submitted,

AMIN & TUROCY, LLP



Himanshu S. Amin

Reg. No. 40,894

AMIN & TUROCY, LLP
24TH Floor, National City Center
1900 E. 9TH Street
Cleveland, Ohio 44114
Telephone (216) 696-8730
Facsimile (216) 696-8731